Network Loading Visibility for Management

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The responsibilities of the Deep Space Network (DSN) Operations Scheduling Group (NOSG) are outlined. The long-range scheduling portion of the NOSG is explained in detail. Examples of the DSN Forecast, published quarterly by the NOSG, are also included.

The Deep Space Network (DSN) Operations Scheduling Group (NOSG) has the responsibility of forecasting, allocating and scheduling the utilization of the DSN facilities in response to requirements from all of its users such as flight projects, radio science, and DSN development. In addition, requirements which are internal to the DSN such as maintenance, engineering, training and facility updates must be forecast, allocated and scheduled. The NOSG is also responsible for providing management with information which will give them visibility concerning mission support, facility utilization and Network loading.

The official NOSG publications which comply with these responsibilities are as follows:

1. *Seven-Day Schedule* — Detailed schedule for the coming week. Published weekly.

2. *Mid-Range Schedule* — Time-sensitive schedule of facility activities for each day for the next 8 weeks.

Provides the basis for the Seven-Day Schedule. Published monthly.

3. *Forecast* — Gross planning of Network allocation for the next 3 years. Provides the basis for the Mid-Range Schedule. Published quarterly.

To provide management with the assessment required, a method for displaying the data is available. It consists of a set of *Network Requirements and Allocation Charts*, which display the requirements placed on the Network by users, the capability of the Network and the planned allocation of that capability to the various users in accordance with established priority guidelines. The total requirements, allocations and capability are displayed at the bottom of the chart just above the calendar. Major milestones are displayed across the top of the chart as an aid to correlating requirements (loading) with events. Figure 1 is an example of this chart. Note that it covers two fiscal years, FY 1975 and FY 1976, in 4-week increments, for the 26- and 64-meter stations at the Goldstone longitude (DSSs 11, 12 and 14). A complete set

of charts comprises 9 charts; 3 for each of the three longitudes at which the DSN has Deep Space Stations (DSSs), namely the Goldstone longitude (DSSs 11, 12 and 14), the Australian longitude (DSSs 42, 43 and 44) and the Spanish longitude (DSSs 61, 62 and 63). The three charts for each longitude cover the years of interest; one prior year, the current year and two future years.

For the purpose of long-range forecasting, the following guidelines are used in establishing the capabilities of the Network. The available station hours, as defined by the budget, are divided into two basic categories. Seventy percent are allocated for DSN user support and thirty are allocated for facility internal activities. Also, for long-range forecasting, a "pass" is considered to be an average of 12 hours in duration. To determine the capability in "passes per 4 weeks," the station hours are multiplied by 0.7, divided by 12, rounded to the nearest whole number and then multiplied by 4. Thus, a station which is staffed for 120 hours per week (3 shifts) would be allocated 84 hours per week for user support, which will provide a capability of 7 passes per week or 28 passes per 4-week period.

For "quick-look" display and for convenience in planning support of future requirements on the Network, a set of "residual" graphs is made. Figure 2 is an example of this chart. These graphs show the difference between the total requirements for each antenna size and the total capability at each longitude. The time scale shown in Fig.

1 is used. When the requirements exceed the capability, the difference is plotted as a positive (+) value and indicates an "overload" and a conflict. If the requirement is less than the capability, the difference is plotted as a negative (–) value, representing an "underload" and no conflict. The zero line represents the capability. The scale is in increments of 8 passes per 4-week period. This value was chosen for convenience because, to a first-order approximation, 8 passes represents the difference in capability resulting from changing the staffing at a station by one shift over a 4-week period.

Because of the method of display and the scales that have been chosen, these charts and graphs provide management with the visibility of Network loading and provide the basis on which decisions can be made concerning budgeting, station staffing and negotiations among Network users.

The DSN has some users whose requirements are of a nature which makes it possible to use the charts to "smooth" the loading on the Network. This can be done because their requirements, unlike those of flight projects, are not sensitive to time of day or specific days. Radio science, DSN development, Pioneer 6–9 coverage and certain types of tests fall into this category. The detailed scheduling of this support is usually accomplished during the eight-week and seven-day scheduling process in a manner which meets the broad requirements and also aids in normalizing the loading on the Network.

PROJECT	ANTENNA SIZE																											

▼HELIOS 1 LAUNCH VIKING A LAUNCH▼ ▼HELIOS B LAUNCH ▼HELIOS 1-3rd PERIHELION
▼PN 11 JUP ENC ▼HELIOS 1 1st PERIHELION ▼VIKING B LAUNCH HELIOS 2-2nd PERIHELION ▼▼
▼MVM 73-2nd MERC ENC ▼MVM 73-3rd MERC ENC ▼HELIOS 1 2nd PERIHELION HELIOS 2-1st ▼▼ PERIHELION ▼VIKING ENC

PIONEER 10	26-METER	16 19	16 23	8 25	25	19	7	17	13	16	14	26 17	26 14	28 8	24 6	10 10	25 22	26 11	24 8	28 12	19 19	14 14	7 7	26 26	26 24			
	64-METER	4 2	4 1	12 0	20 3	20 7	20 2	22 9	20 3	20 11	2 3	2 7	0 4	2 6	12 1	3 2	2 14	4 16	0 14	9 0	14 0	21 1	2 2	2 2	19 7	20 7	25 7
PIONEER 11	26-METER	24 20	12 9	24 0	23 8	24 25	24 20	18 16	24 25	24 25	17 21	18 20	21 23	17 14	16 18	19 16	17 8	19 6	18 8	20 20	20 20	20 20	22 22	19 17	19 19	20 20	21 21
	64-METER	4 5	16 20	24 30	23 15	4 1	4 4	10 4	4 1	4 2	2 3	2 4	2 2	2 1	2 2	7 7	2 4	2 13	2 10	2 0		2 1	2 2	7 6	2 1	2 1	2 1
MARINER VENUS MERCURY 10	26-METER	(14) 1	(4) 11	(7) 11	(8) 6	(6) 0	(7) 0	(8) 4																			
	64-METER	(16) 6	(1) 4	(3) 1	(2) 3	(3) 8	(3) 11	(9) 2																			
HELIOS 1	26-METER	3* 8	8* 4	25 25	24 28	25 22	15 13	10	6	1	6	11	11	1 1	(4) 4	(8) 0	(8) 0	(8) 0	(8) 0	(8) 4	(6) 6						
	64-METER	1* 0	6* 1	3 1	4 2	3 4	13 12	28 15	(28) 16	(28) 10	(16) 12	(12) 9	(12) 11	(16) 17	(14) 0					(18) 0	(14) 0						
VIKING 75	26-METER	6* 7	7* 3	4* 0		1* 6	8* 8	9* 8	3* 6		2* 8	4* 11	4	28 31	10 10	18 18	31 31	28 28	26 26	15 15	20 20	5 5	2 2	23 23	37 37	34 34	31 31
	64-METER	12* 0	14* 0	2	1* 7	7* 9	7* 6	9* 3	2* 3	12	2* 3	6* 11	14 2	31 10	35 35	30 30	13 13	1 1	2 2	25 19	16 13	34 34	30 30	28 28	28 28	28 28	28 28
HELIOS B	26-METER											2* 0	4* 2	5* 5	8* 8	14 14	22 22	18 18	6 6								(4) 4
	64-METER														6 6	10 10	22 17	28 23	(28) 2	(28) 2	(28) 0	(4) 0	(16) 0	(14) 0			
PIONEER 6-9	26-METER																										
	64-METER							4	1	2																	
MULTI-MISSION SUPPORT	26-METER	2	2	1	1	1	1	1	2				2														
	64-METER		1	1		1	3	3	6	2	3	3	3	1													
RADIO SCIENCE	26-METER	2	1	1		1	2	1				2															
	64-METER	[8] 1	[8] 6	[8] 4	[8] 6	[8] 8	[8] 3	[8] 4	[8] 5	[8] 3	[8] 7	[8] 1	[8] 12	[8] 4	[8]	[8]	[8]	[8]	[8]	[8]	[8]	[8]	[8]	[8]	[8]	[8]	[8]
DSN DEVELOPMENT	26-METER												1														
	64-METER	[2] 0	[2] 1	[2] 0	[2] 0	[2] 0	[2] 0	[2] 0	[2] 2	[2] 1	[2] 1	[2] 0	[2] 2	[2]	[2]	[2]	[2]	[2]	[2]	[2]	[2]	[2]	[2]	[2]	[2]	[2]	[2]
TOTAL PASSES REQUIRED/ALLOCATED	26-METER	63 59	47 53	68 63	55 62	56 57	54 59	35 53	27 57	24 46	45 52	48 58	55 50	75 57	53 53	78 64	96 64	101 64	98 64	68 60	60 32	32 32	50 50	68 64	56 56	54 54	56 56
	64-METER	37 14	41 34	42 39	50 36	37 38	47 41	78 40	54 40	52 42	22 34	22 35	28 36	51 39	63 36	40 36	17 36	13 36	14 36	58 36	76 36	99 36	62 36	65 36	53 36	66 36	69 36
TOTAL PASSES AVAILABLE	26-METER	56	56	56	56	56	56	56	56	56	56	60	64	64	64	64	64	64	64	64	64	64	64	64	64	64	64
	64-METER	9	27	36	36	36	36	36	36	36	36	36	36	36	36	36	36	36	36	36	36	36	36	36	36	36	36

RADIO SCIENCE 64-METER: ALLOCATED ON TIME-AVAILABLE BASIS
DSN DEVELOPMENT 64-METER: ALLOCATED ON TIME-AVAILABLE BASIS

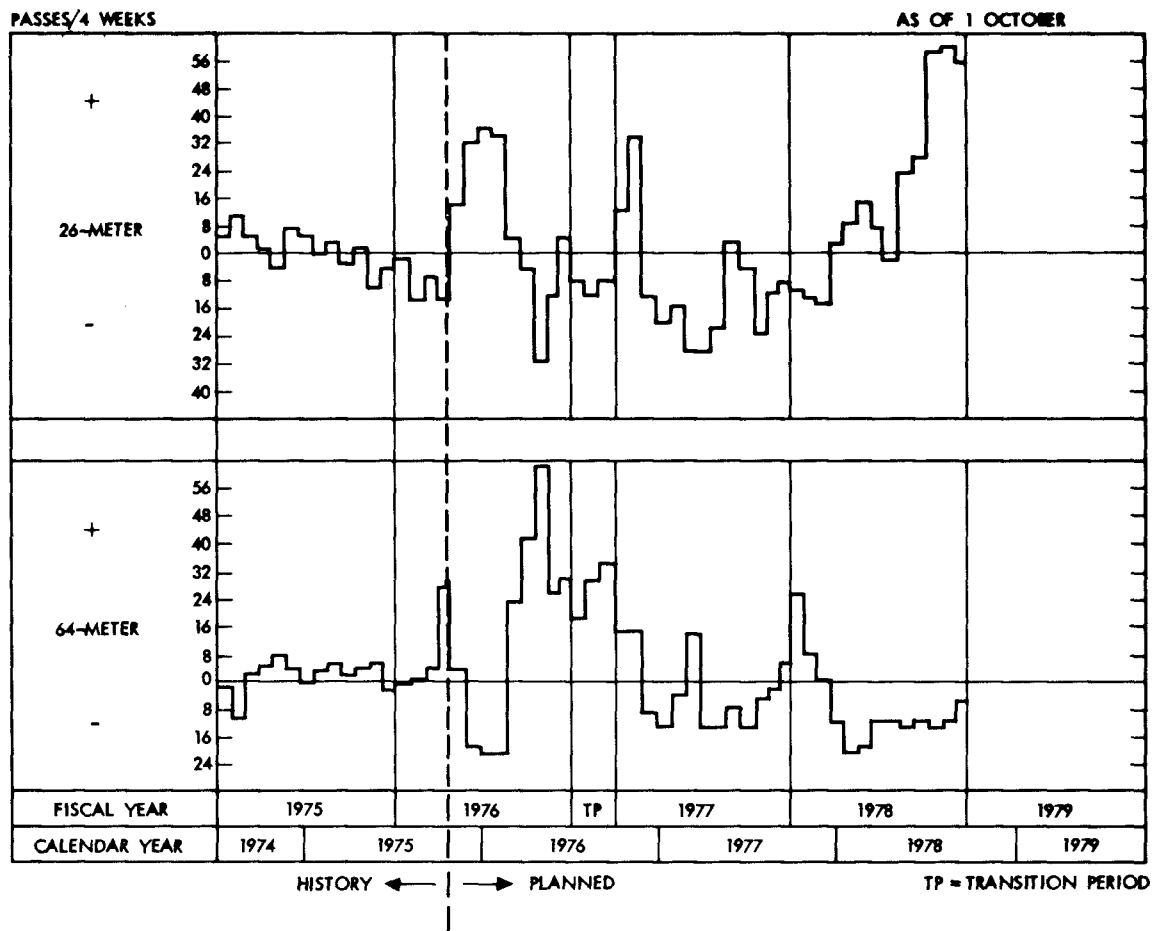| REQUIRE-MENTS | WEEKS | 39 42 | 43 46 | 47 50 | 51 2 | 3 6 | 7 10 | 11 14 | 15 18 | 19 22 | 23 26 | 27 30 | 31 34 | 35 38 | 39 42 | 43 46 | 47 50 | 51 2 | 3 6 | 7 10 | 11 14 | 15 18 | 19 22 | 23 26 | 27 30 | 31 34 | 35 38 |
XX/XX ALLOCATION X Not included in totals (X) EXTENDED MISSION	FISCAL YEAR	1975													1976											TP	
	CALENDAR YEAR	1974			1975										1976												
* TESTS ** NIB	MONTHS	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP		

HISTORY ▶◀ PLANNED

Fig. 1. DSN forecast, Goldstone

Fig. 2. Network requirements less Network capabilities, Goldstone